The Cost of Congestion: The True Costs of Slowing the Distribution Networks

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Project Overview:

• Congestion on the urban road network in the United States is estimated to cost the nation about $85 billion annually (USDOT, 2009), as each and every vehicle using the public roadway system experiences some degree of:
  
  • Wasted fuel
  • Lost productivity
  • Reduced mobility

• The cost value is large, but can it inform state level policy?

  • Additional knowledge is needed to understand:
    • How industries are impacted by congestion
    • What their likely response will be to increasing congestion
    • The net impact of these industry responses to the Washington State economy.
Step 1: Survey Freight Dependent Industries in Washington State

Design CATI

Administer CATI to 6,624 private-sector freight companies and carriers

1,062 Respondents

Step 2: Calculate Direct Costs of Congestion to Freight Dependent Industries

Calculate total revenue of freight dependent industries from IMPLAN

Calculate increased trucking and inventory costs due to congestion by industry

Estimate the direct costs of congestion to freight dependent industries (Assuming 60% of costs are passed to consumers)

Step 3: Translate Rising Business Costs into Gains or Losses of Jobs and Output for Each Industry

Enter direct costs into IMPLAN models

Link trade flow data from each regional IMPLAN model

IMPLAN multipliers translate costs into direct, indirect and induced impacts:
- Industry output
- Industry employment

Step 4: Evaluate the Losses and Gains (in Employment and Industry Output) to Determine the Regional and Statewide Impacts of Congestion
### Step 2: Calculate the Direct Costs of Congestion to Freight-Dependent Industries

<table>
<thead>
<tr>
<th>Industry</th>
<th>Revenue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture, Forestry, Fishing*</td>
<td>$14,025,087,392</td>
</tr>
<tr>
<td>Mining*</td>
<td>$1,722,882,632</td>
</tr>
<tr>
<td>Construction</td>
<td>$39,590,105,088</td>
</tr>
<tr>
<td>Manufacturing*</td>
<td>$160,187,755,858</td>
</tr>
<tr>
<td>Retail Trade**</td>
<td>$111,814,709,161</td>
</tr>
<tr>
<td>Wholesale Trade**</td>
<td>$142,323,314,397</td>
</tr>
<tr>
<td>Transportation/Warehousing*</td>
<td>$16,754,995,185</td>
</tr>
<tr>
<td>Waste Management</td>
<td>$3,589,177,344</td>
</tr>
</tbody>
</table>

- Calculating Total Revenue:
  - Two modifications from IMPLAN’s output values:
    - Subtracted the value of inventory from output to reflect actual sales (*)
    - Adjusted using margins to show the total value of the goods sold (**)
### Step 2: Calculate the Direct Costs of Congestion to Freight-Dependent Industries

<table>
<thead>
<tr>
<th>Industry</th>
<th>Inventory Cost</th>
<th>Trucking Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture, Forestry, Fishing</td>
<td>0.01%</td>
<td>6.00%</td>
</tr>
<tr>
<td>Mining</td>
<td>0.00%</td>
<td>9.24%</td>
</tr>
<tr>
<td>Construction</td>
<td>0.04%</td>
<td>8.28%</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>0.42%</td>
<td>6.04%</td>
</tr>
<tr>
<td>Retail Trade</td>
<td>0.34%</td>
<td>2.59%</td>
</tr>
<tr>
<td>Wholesale Trade</td>
<td>0.23%</td>
<td>3.16%</td>
</tr>
<tr>
<td>Transportation/Warehousing</td>
<td>0.04%</td>
<td>6.51%</td>
</tr>
<tr>
<td>Waste Management</td>
<td>0.00%</td>
<td>2.86%</td>
</tr>
</tbody>
</table>

- **Inventory Costs** (as percent of total revenue) based on need to hold inventory to combat congestion.

- **Trucking Costs** represent need for additional trucks, and used in conjunction with reported hourly trucking costs ($55-light, $76-heavy, $59-mixture)
**Step 2: Calculate the Direct Costs of Congestion to Freight-Dependent Industries**

<table>
<thead>
<tr>
<th>Industry</th>
<th>Direct Cost of Congestion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture, Forestry, Fishing</td>
<td>$505,744,651</td>
</tr>
<tr>
<td>Mining</td>
<td>$95,516,613</td>
</tr>
<tr>
<td>Construction</td>
<td>$1,976,338,046</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>$6,208,877,417</td>
</tr>
<tr>
<td>Retail Trade</td>
<td>$1,965,702,587</td>
</tr>
<tr>
<td>Wholesale Trade</td>
<td>$2,894,856,215</td>
</tr>
<tr>
<td>Transportation/Warehousing</td>
<td>$658,471,311</td>
</tr>
<tr>
<td>Waste Management</td>
<td>$61,590,283</td>
</tr>
</tbody>
</table>

- Totals nearly $14.4 billion
- 20% congestion increase
- 60% cost realization
Step 3: Translate Rising Business Costs into Gains or Losses of Jobs and Output for Each Industry: Consumer Costs

- Consumers must decrease purchases of services and non-freight dependent goods to pay for the increased costs of freight dependent goods.

- Household consumption function in IMPLAN was modified to incorporate the spending decrease.
  - Weighted by population and income
Step 3: Translate Rising Business Costs into Gains or Losses of Jobs and Output for Each Industry: Societal Benefits

- Freight dependent business must increase spending on resources to counteract increased congestion.
  - Congestion as an inefficiency
  - Spending on Insurance and Capital is placed in corresponding IMPLAN industries.
  - Wages models as an increase to employee compensation
Step 4: Evaluate the Losses and Gains to Determine the Statewide and Regional Impacts of Congestion

Positive Economic Impacts:
Industries add employees and assets to combat congestion

Negative Economic Impacts:
Costs to consumers rise and lead to decreased spending on other industries

- Industries add 17,831 jobs
- Industry output grows $3.03 billion
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- Industries lose 45,088 jobs
- Industry output declines $6.34 billion
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Positive Economic Impacts: Industries add employees and assets to combat congestion

Negative Economic Impacts: Costs to consumers rise and lead to decreased spending on other industries

Industries add 17,831 jobs

Net loss of 27,257 jobs (0.7 percent of statewide total) and $3.3 billion (0.5 percent of statewide total) of industry output
## Step 4: Evaluate the Losses and Gains to Determine the Statewide and Regional Impacts of Congestion

<table>
<thead>
<tr>
<th>Industries incurring additional expenditures in order to combat congestion</th>
<th>Industries suffering from reduced expenditures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transportation and Information</td>
<td>Health and Social Services</td>
</tr>
<tr>
<td>Administrative Services</td>
<td>Real Estate and Rental</td>
</tr>
<tr>
<td>Retail Trade</td>
<td>Finance and Insurance</td>
</tr>
<tr>
<td>Wholesale Trade</td>
<td>Accommodation and Food</td>
</tr>
<tr>
<td>Government</td>
<td>Arts and Entertainment</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>Construction and Utilities</td>
</tr>
<tr>
<td>Management of Companies</td>
<td>Professional and Scientific</td>
</tr>
<tr>
<td>Mining</td>
<td>Educational Services</td>
</tr>
<tr>
<td></td>
<td>Ag, Forestry, and Fishing</td>
</tr>
</tbody>
</table>
Step 4: Evaluate the Losses and Gains to Determine the Statewide and Regional Impacts of Congestion

Statewide Total
- $4.6 billion output
- 29,500 jobs

Northeast
- Impact: $290 million output
- 2,200 jobs

Northwest
- Impact: $162 million output
- 1,800 jobs

Puget Sound Metro
- Impact: $3.6 billion output
- 21,700 jobs

Central Basin
- Impact: $244 million output
- 1,800 jobs

Southwest
- Impact: $266 million output
- 1,600 jobs

Southeast
- Impact: $31 million output
- 345 jobs

<table>
<thead>
<tr>
<th>Region</th>
<th>Employment</th>
<th>Output ($millions)</th>
<th>Percentage of Regional Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Employment</td>
<td>Output</td>
<td>Employment</td>
</tr>
<tr>
<td>Northwest</td>
<td>-1,786</td>
<td>-$162</td>
<td>-0.48%</td>
</tr>
<tr>
<td>Southwest</td>
<td>-1,622</td>
<td>-$266</td>
<td>-0.52%</td>
</tr>
<tr>
<td>Central Basin</td>
<td>-1,793</td>
<td>-$244</td>
<td>-0.47%</td>
</tr>
<tr>
<td>Northeast</td>
<td>-2,213</td>
<td>-$290</td>
<td>-0.77%</td>
</tr>
<tr>
<td>Southeast</td>
<td>-345</td>
<td>-$31</td>
<td>-0.31%</td>
</tr>
<tr>
<td>Puget Sound</td>
<td>-21,741</td>
<td>-$3,600</td>
<td>-0.90%</td>
</tr>
<tr>
<td>Statewide Total</td>
<td>-29,500</td>
<td>-$4,600</td>
<td>-0.76%</td>
</tr>
</tbody>
</table>
Lessons Learned and Recommendations:

• What do these Findings Suggest for WSDOT’s Policies Towards Addressing Congestion on Corridors Used by Trucks?
  • The state’s economic vitality and livability depend on reliable, responsible, and sustainable transportation.

• Congestion causes increased direct transportation costs to freight-dependent industries – which translate to increased costs of goods and services to consumers in Washington State.
  • Creates an operational efficiency problem for freight dependent firms: Trip Time ↑ Unproductive time in Traffic ↑ Productivity ↓ resulting in $14 Billion of increased operating costs.

• These demonstrated economic impacts suggest that WSDOT should prioritize investments that enhance mobility for trucks and freight industries as a way to support the State’s goals of a strong economy.
Lessons Learned and Recommendations:

- Imbedding investment Principles into WSDOT’s *Moving Washington*:
  - Operate Efficiently
  - Manage Demand
  - Add Capacity Strategically
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